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Financial Analysis of Independent Power Projects In India

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This paper aims at giving an insight into the financial analysis of the independent power projects in India (IPP), under Government Power Policy, 1996. These projects are generally executed on BOOT basis, wherein the IPPs build, own, operate and then transfer the project to statutory authorities. The project appraisal using Net Present Value (NPV) method is attempted. This is followed by risk analysis using Monte-Carlo simulation technique. Impact on NPV is studied using sensitivity analysis, where one variable affecting NPV is varied at a time keeping all other parameters constant. The result of this study indicates that based on power policy (1996), the IPPs are financially viable. The conclusions of the paper will be useful to promoters planning to enter the power generation industry. This is an exercise in valuation of an IPP, which will be useful even when mergers and acquisitions in the industry take place.

INTRODUCTION

In the infrastructure sector, power is one of the important sectors for the development of an economy. According to estimates of Central Electricity Authority (CEA), done in 1996, in the next 15 years India needed additional 1,40,000 MW capacity which would cost about USD 120 billion (at 1996 prices) to achieve the targeted growth of GDP. The government was not in a position to earmark this huge outlay for one particular sector. Besides, the public sector companies were not in a position to either add the additional capacity with their own resources, nor were they in a position to modernize their generating abilities without additional infusion of funds from government. In this scenario, the government decided to open up the sector for private and international participation to attract investments and latest technology. These projects could be executed either on BOO and/or BOOT basis depending upon the agreements that are entered into between the Government and the IPPs (see Box 1 for salient features of Government Power Policy 1996) (Raghuram, Jain, Sinha, Pangotra and Morris (2001).

Looking at the amount of capital commitment and high expectations from private participation in this sector, financial analysis in power projects becomes a necessary exercise. One study by Esther Malini (1996) pertains to investment analysis in transport infrastructure project. Another study by Economic Development Institute of World Bank attempts investment risk evaluation in the context of co-generation project. There has been no formal study on financial analysis in power sector in the Indian context. The present paper aims at evaluating the financial viability of a power project under the 1996 power policy guidelines.

Following are the specific objectives of this study:

- To appraise the power projects using net present value and analyze the risk thereon using Monte Carlo simulation technique.
- To analyze the impact on NPV by carrying out a sensitivity analysis.

METHODOLOGY

Independent Power Project (IPP) is an entity conceptualized over the period taking concrete form in the year 1996 with the Government announcing the power policy for IPPs. The study relies on data collected from IPPs through survey. Based on the data thus collected, a model power project with representative financial statistics is considered for investment appraisal using NPV method and simulation (see Box 2 and 3) in this paper. 56% of the total IPPs are thermal projects. Hence, we have considered a thermal IPP in this study.

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Survey

A detailed survey in two parts was conducted, which facilitated procurement of data for variables considered in the case study. One survey, on an all India basis, through a detailed questionnaire elicited information on different issues in IPP sector in India. The respondents, nearly 20 in number, for this survey were basically the existing power generating companies, both in the public and private sector and those corporate entities who had either set up or were in the process of setting up a power project. This survey provided data for the simulation exercise.

The second survey focused on getting data on the inputs like interest rate, inflation, etc. for sensitivity analysis. The respondents, nearly 10, for this survey were academicians, economists, and experts in the power industry.

Case Study

In this study, we start with a model power project. The initial investment is taken as Rs. 200.00 crores based on the ideal debt-equity ratio for power projects, which has been obtained from the survey. The basic project statistics, the exogenous variables and the macro economic parameters considered in the case study are given below :

Project statistics

Capacity of the project	250 MW
Cost per MW	Rs. 4.00 crores
Total Cost of the project	Rs. 1000 crores
Debt -Equity	4 : 1
Equity	Rs. 200.00 crores

Simulation

Use of simulation in capital budgeting dates back to the well known work of Hertz (1964) which has now evolved into a methodology in project appraisal (Prasanna, 1995). But since the pricing of output of IPPs is unique so as to get an assured return to the IPPs, the resultant cash flows are different from typical project net cash-inflows as described in relevant literature (Prasanna, 1995).

The power policy prescribed an assured rate of return of 16% on the equity at a base level of 68.5% plant load factor (PLF) achieved (Jain, 1998). For additional PLF achieved, there is an incentive (see Box 4 for details). Hence, the rate of return (RoR) earned by an IPP is :

RoR = 16 + (PLF-68.5) * incentive factor

This is the assured rate of return on equity earned by an IPP. All costs like interest on debt, depreciation, taxes, foreign exchange fluctuations and all other variable costs are a pass through to the consumers. Hence, the annual net cash-inflows for an IPP will be Rs. 200 crores * RoR (in %).

For the purpose of considering cash flows, the residual value, based on the survey results, of the project is considered as 5% of the total project cost and the same is reckoned in the 25th year along with cash flow for the 25th year.

The promoter brings in equity, raises debt, builds the facility, generates and sells power and repays the debt along with interest. The tariff for the power is so fixed that the promoter is assured a minimum rate of return of 16% return if he achieves 68.5% PLF. On equity of Rs. 200 crores, the promoters earn a return as above after bringing in the debt required and also repaying the same. Hence, the initial cash flow for this project is Rs. 200 crores from the promoter's point of view, even though the total fund invested is Rs.1000 crores (Prasanna,1995).

Simulation Process

In this exercise, PLF, construction period and incentive are exogenous variables. The probability distribution of these variables are described in Appendix 1. The discount factor, the power purchase agreement (PPA) validity period are other parameters. The discount factor has taken at 14% and the PPA validity period as 25 years (see Box 3, 4 and 5 for details).

As described already,
RoR = 16% + (PLF-68.5)*incentive factor
Using random numbers, one set each for PLF, construction period and incentive, we obtain the random variates of the corresponding three probabilistic variables PLF, construction period and incentive. Then we compute cash flows as RoR (in %) * Rs. 200 crores.

With this, we compute NPV for each simulation run using a program specifically designed in C++. We simulated an experience of 10000 runs.

Using the results of the simulation analysis the risk profiles for the net present value and the associated arithmetic mean, standard deviation and co-efficient of variation are computed. They are as follows:

Mean net present value (Rs in crores)	38.64
Standard deviation	7.40
Co-efficient of variation (%)	19.16

Managerial implication of simulation

The risk profile for net present value has been presented in the form of a probability distribution (see Figure 1). At any point of time, the NPV has not gone below zero. With range of values, it could be seen that with the present policy prevailing an average NPV of Rs. 38.64 crores can be obtained. In view of this, the IPPs are well placed as they can recover their investment provided the assumption that has been made and the current policy guidelines are implemented in letter and spirit.

Sensitivity Analysis

The case study described above addresses the issue of project viability. It does not discuss as to what would happen, if some of the inputs, where at present, guarantees are given, were to change. Whether or not one is armed with the probabilistic data, one of the first actions in such a scenario is to identify the critical variables, which one is handling. This process involves removal of the insignificant to leave the critical factors more clearly visible. Valuable insights can therefore be obtained by sensitivity analysis applied to the above model. This analysis thus, gives the sensitiveness of the NPV to the different parameters.

Procedure for sensitivity analysis:

1. Method for computation of cash flows is same as the one used in simulation exercise.
2. Only one factor is varied at a time in order to understand the relationship and the effect of that particular factor on NPV.
3. The following inputs are taken for the purpose of arriving at the rate of return.
   a. Plant load factor is 85%, which is the mean PLF achieved by IPPs as per the survey.
   b. Incentive factor of 0.6% for every increase of 1% PLF, which is the mean incentive achieved by IPPs as per survey.
4. Cash inflows and outflows are discounted @ 14% unless specified otherwise.
5. Cash flows are arrived at for a period of 25 years unless specified otherwise.

We shall now see the critical factor (i.e., discount factor), which has a high impact on the returns, thereby facilitating the project owners to focus on this critical factor.

Discount factor/Opportunity cost

A range of discount factors from 9% to 18% is used to discount the cash in-flows. The effect of the same on the NPV is given in Table 1.

From Table 1, it is clear that a project having a discount factor as high as 16% can still be viable. In the scenario of falling interest rates, the investment proposal looks very attractive.

Effect of inflation on NPV: According to Fischer's formula, nominal interest rate equals real interest rate plus inflation. (Prasanna, 1997).

A nominal discount rate of 14% is inclusive of inflation. If the rate of inflation averages to 5%, it means the real discount rate is 9%. Thus in the above case, we have considered inflation from nil to 9%, the real discount rate being 9%. If the inflation is nil, the project earns an NPV of Rs. 168.34 crores. When the inflation goes upto 7%, making the nominal discount rate equal to

Table 1 : Effect of Discount Factor on the NPV of a Project at Different Discount Rates

Rates	9	10	11	12	13	14	15	16	17	18
NPV	168.4	132.72	102.11	75.72	52.87	33.02	15.73	03.62	(12.63)	(24.27)

Table 2 : Effect of Discount Factor on the NPV of a Project When the Initial Investment is Brought in Two Equal Instalments

Rates	9	10	11	12	13	14	15	16	17	18
NPV	175.91	140.98	111.04	85.28	63.05	43.80	27.07	12.51	(0.21)	(11.35)

16% the project earns a positive NPV. If the inflation goes above 7%, the NPV becomes negative and the project becomes unviable.

When equity is brought in two equal annual installments :

In the above case we presumed that the initial investment of Rs. 200.00 crores is made in year one in one shot itself. If the promoter brings this initial investment in two equal annual installments in year I and 2, then would it have any impact on his return and viability of the project?

A comparison of Tables 1 and 2 shows that the NPV of the project will be higher at different discount rates when equity is brought in two equal annual installments. Hence, the promoter should try and arrange to get equity outlay in installments, thereby maximizing the return. It would be ideal if initial funds are tied up through debt.

Construction period

Though the survey findings say that the project takes 36 months to be brought into operations, what happens if the said project can be completed early or gets delayed. Table 3 shows the effect of project completion on NPV.

Table 3 : Effect on NPV and IRR When the Construction Period is Varied

Years	2	2.5	3	3.5	4	4.5
NPV	63.69	48.36	33.02	19.57	6.121	(5.68)
IRR	18%	17%	16%	15%	14%	14%

It would also be interesting to note that if the initial investment were brought in two equal installments in year 0 and year I, the outcome would be as presented in Table 4.

Table 4 : Effect on NPV and IRR When the Construction Period is Varied and the Intial Investment is Made in Two Equal Installement

Years	2	2.5	3	3.5	4	4.5
NPV	74.47	59.13	43.80	30.34	16.89	5.09
IRR	19%	18%	17%	16%	15%	14%

PPA validity period

The results of the survey indicate that most of the PPAs entered into or proposed to be entered into are for a period of 25 years. What would happen if the PPA validity period were increased by another 5 years or reduced by 5 years? The effect of extension and reduction in the PPA period can be seen in Table 5.

Table 5 : Effect on NPV and IRR When the Validity of PPA is Varied

Years	20	25	30
NPV	23.21	33.02	38.12
IRR	16%	16%	16%

Table 5 shows that if the PPA validity period comes down to 20 years, it will bring down the project NPV by Rs. 9.81 crores and the IRR does not follow the same trend. Also if the period goes up to 30 years, the project NPV does not go up proportionately besides there is no change in the IRR.

Rate of return at higher plant load factor

As per 1996 policy, the government had fixed the rate of return on the capital invested @ 16% at 68.5 plant load factor (PLF). Thereafter, for every 1% increase in the PLF, the incentive factor up to maximum amount of 0.7 % is allowed to be given. This rate of return is fixed based on the performance of public sector power units, which is poorly maintained. However, with high plant load factor achieved by couple of independent power

Table 6 : Effect on NPV at Different Discount Rates When the Rate of Return is Fixed at 75 PLF Instead of 68.5 PLF

Rates	9	10	11	12	13	14	15	16	17	18
NPV	116.16	85.98	60.10	37.82	18.57	1.88	(12.63)	(25.28)	(36.34)	(46.04)

projects and lot of public outrage regarding the higher rate of return being given to independent power producers, the government is rethinking of fixing the return at higher PLF.

Table 6 gives the effect on the NPV at different discount rates when the rate of return of 16% is fixed at 75 PLF instead of 68.5 PLF.

Let us take that the government does not change the normative PLF, but changes the rate of return itself. Following table would give the effect of NPV and IRR when the rate of return is reduced at a normative PLF level of 68.5% level. The outcome is given in Table 7.

Table 7 : Effect on NPV and IRR When the Rate of Return is Reduced at Normative PLF Level of 68.5%

Rates	14%	15%
NPV	17.05	25.04
IRR	15%	16%

An important observation here is that the NPV does not vary much when the rate of return is reduced at normative level as compared with the case when the assured rate of return is 16% at a higher PLF (i.e., 75% instead of 68.5% PLF). This gives a tool for power producers to present their case asking the government to consider the option of lower rate at 68.5% PLF as compared to 16% return at higher PLF.

Residual value

At the end of the PPA validity period, the power plant is either handed over to SEB or the power producer is allowed to continue to use, but with lot of stringent clauses. In the model we have assumed that the power plant is handed over to the SEBs at the end of the PPA validity. In such a scenario, the residual value can be anywhere between 5-10% of the total project cost itself. Thus, it would be interesting to see, how the NPV and IRR would behave for a situation where in the plant has a 10% residual value at the end of the 25th year.

However, experts are of the opinion that there should not be any terminal payment at the end of the PPA validity as consumers in the form of demand charges have paid the cost of the plant.

However, the question is to what extent these issues are significant. Tables 8 and 9 give the effect on NPV and IRR at different discounting rates reckoning residual value of 10% of the total project cost and the other one without considering the same.

Looking at the two tables, it may be observed that the residual value in principle does not add much value to facilitate the decision making process.

Thus, it can be seen from the above that sensitivity analysis goes a long way in identifying the key elements, which may lead to a particular outcome. This in turn

Table 8 : Effect on NPV When there is no Residual Value at the End of 25th year

Rates	9	10	11	12	13	14	15	16	17	18
NPV	163.02	128.52	98.79	73.09	50.78	31.37	14.41	(0.44)	(13.47)	(24.95)

Table 9 : Effect on NPV When there is a Residual Value of 10% of the Project Cost at the End of 25th year

Rates	9	10	11	12	13	14	15	16	17	18
NPV	173.66	136.91	105.43	78.34	54.95	34.68	17.05	1.67	(11.79)	(23.60)

would provide an opportunity to the investor to strive for or avoid certain elements/situations. Combined with the simulation, sensitivity gives altogether a new dimension in the process of decision-making and the major infrastructure project decisions are no exception to this.

Limitations of the study

- Study is based on the thermal power projects.
- Study is time bound and due to changes taking place in the government policies, the results may not be sustained over a period of time.
- It is assumed that all the agreements entered into with different agencies will be honoured.

Findings and conclusions

- The return earned by an IPP depends on construction period, PLF and incentive rate.
- For a PPA validity period of 25 years and a discount rate of 14%, an IPP is financially viable, and earns a NPV of Rs. 38.64 crores for an equity investment of Rs. 200.00 crores.
- At a mean PLF of 85%, a mean incentive of 0.6% and a mean construction period of 3 years, the project is viable even if the discount rate goes upto 16%. If the discount rate comes down to 9%, the IPP can earn a NPV of Rs. 168.34 crores.
- Bringing the equity in two equal installments enhances the earning capacity of an IPP. When equity is brought in two equal installments, the NPV goes upto Rs. 43.80 crores at a discount rate of 14%. Hence, it is advisable to fund the initial commitment of the project through debt.
- Also, if the promoters are able to complete construction in 2 years, the IPP will be able to earn an NPV of Rs. 63.69 crores.

In the light of the above, IPPs are not only financially viable, but also an attractive investment opportunity.

Usefulness of the work

This analysis will be useful to promoters planning to enter the power generation industry. Further, it will also be useful as an exercise in the valuation of an IPP when mergers and acquisitions take place. It is useful to policy makers in designing appropriate pricing policies and also to developmental financial institutions in their lending decisions.

Future areas of work

Project appraisal technique presented in this paper can be replicated in other infrastructure sector like telecom, shipping, railways, etc to assess the economic viability of an investment by a private entrepreneur.

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APPENDIX-1

Following data is based on the response obtained by 3 existing licencees, I operational IPP and the rest from IPPs, which are still to get financial closure. Hence, in some cases, the responses are projections of variables, which the IPPs hope to achieve.

Probability distribution for Construction Period variable

Period	Probability
Less than 36 months	0.05
36 months	0.90
More than 36 months	0.05

Probability Distributions for Plant Load factor

Plant Load Factor	Probability
78-80	0.08
80-82	0.11
82-84	0.19
84-86	0.23
86-88	0.21
88-90	0.11
90-92	0.07

Probability Distributions for Incentive Factor

Incentive	Probability
0.5	0.33
0.6	0.33
0.7	0.34

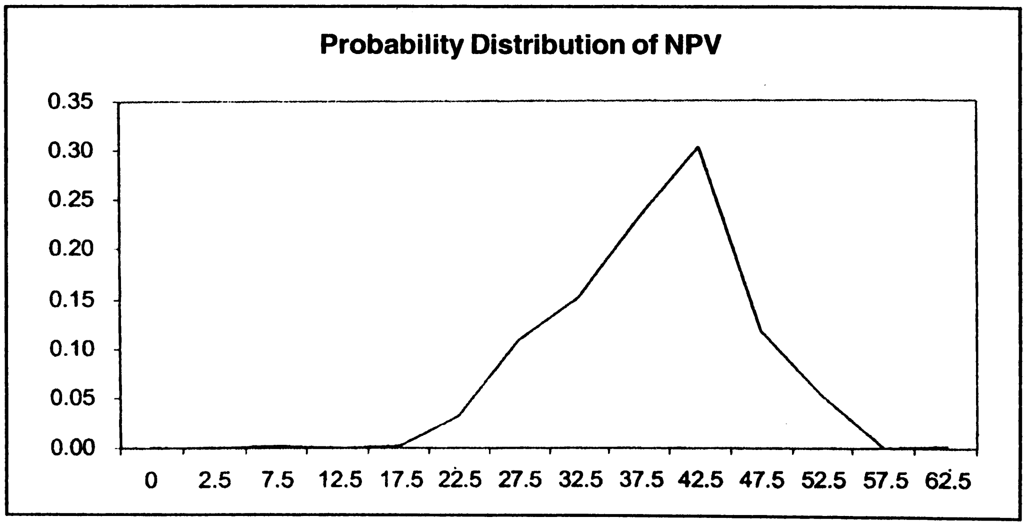

Figure 1 : Probability Distribution of NPV

Box 1: Background of the study and important features of Government Power Policy 1996

Government of India in order to facilitate private participation opened up the power generation industry. The salient features of the policy are:

* Constitution of Electricity regulatory commissions at state and central level.
* Rationalization of tariff.
* Private sector participation in distribution sector.
* Autonomy to State Electricity Boards (SEB).
* Changing the mode of functioning of SEBs.
* Private sector can set up power projects of any size and type.
* To ensure that private participation brings in additional resources to the sector, not less than 60% of the total outlay for the project should come from sources other than Indian public financial institutions.
* Upto 100% foreign equity participation is permitted for IPPs.
* Tax holiday in respect of 100% of the taxable profits in the first five years and 30% taxable profits in the following five years.
* 16% rate of return on equity has been provided, taxes on which would be reckoned as part of demand charges.
* The tariff is based on two-part tariff one to cover the fixed expenses and the other to cover the variable expenses at a prescribed level of performance.

Box 2 : Tools for investment decision-making used in this study

Net Present Value: Net present value is the present value of future cash inflows earned by a project, less initial cash outlay using an appropriate discount rate. "The decision criteria to accept the project depend on whether the net present value is positive or negative".

Monte-Carlo Simulation: It is a method of solving complex probabilistic problems by a process of controlled random sampling.

Box 3 : Steps in Simulation (Chandra, Prasaima (1998) pp 288)

1. Identify the criterion variable, exogenous variables (variables which are probabilistic in nature and are outside the control of the decision maker) and parameters (inputs specified by the decision maker and held constant over all the simulation runs).
2. Model of the project - A model expresses the criterion variable in terms of exogenous variables and parameters.
3. Specify the values of parameters and probability distribution of exogenous variables.
4. Generate random numbers, one each for each of the exogenous variables, determine the corresponding variates of exogenous variables and find the criterion variable.
5. Risk profile: Repeat steps 3 and 4 a large number of times and plot the frequency distribution of the criterion variable, which is called the risk profile.

Box 4 : Variables used in the study

Construction period - The period that is required to set up an infrastructural facility with all the approvals depends on the type of the project. Government policy gives an indicative construction period of 36 months. The probability distribution for the construction period is given in the appendix.

Plant Load Factor (PLF) - Plant Load factor forms the key for generating the returns on the investment made in the power project. PLF here refers to the total time for which the plant is in operation in a given year generating the power. Based on the empirical analysis of the entire state owned power-generating units, the Government has fixed the rate of return on plant load factor. Considering the public sector performance and the keenness on the part of the government to enhance the private enterprise participation in this sector, the rate of return has been fixed at a normative level of 68.5% plant load factor. However, this achievement of plant load factor is dependent on the respective state electricity boards asking the power generators to generate the power. Under power purchase agreement, the state electricity boards have obligation to lift power which will make the private enterprise developed power project to engage itself and achieve 68.5% plant load factor. Beyond this, it is at the sole discretion of the state electricity boards to ask to generate additional power. Hence, an uncertainty has been introduced at this point and the power developer has to get an estimate of the net plant load factor he would achieve, which is not a very simple task at hand. The probability distribution, derived as result of survey is given in appendix 1.

Incentive - when an independent power producer achieves a plant load factor of more than 68.5%, the question is how to determine the return on the additional plant load factor beyond 68.5%. Based on the empirical study of the public sector units by CEA, the same has been fixed between 0.1% to 0.7% for every 1% increase in plant load factor. This incentive factor is also to be decided by the state electricity board and the same is decided based on the plant load factor achieved and other considerations. Hence, the determination of incentive is also uncertain. The probability distribution, derived as result of survey is given in appendix I.

Discount rate - Discount rate is a measure of the minimum expected rate of return the promoters would like to get from the project. The discount rate is generally influenced by the cost of capital, both debt and equity, for the promoter.

Considering the Indian scenario, where interest rate is going down and the policy makers decision to relate the interest rate to the prevailing international interest rate, the authors after obtaining data from the experts on the said macro economic indicator, have taken the discounting factor of 14%, which is based on the LIBOR and reckoned with the country risk and the project risk.

Rate of return - The Government has allowed a 16% rate of return on equity. For the portion of foreign equity, the return upto 16% can be designated in the currency of the subscribed capital to protect it from the foreign exchange fluctuations. The expert opinion survey revealed that government has considered the inflation rate taking into consideration the maturity that the economy is expected to achieve while determining the rate of return of 16% at base level of 68.5% of PLF.

Cash flows - For the purpose of this exercise, the cash inflows are taken based on the return on equity throughout the project life. This is because of the uniqueness of the power project, where in, all the fixed costs like interest, depreciation, taxes on income, etc are recovered as demand

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charges from the consumers. The annual cash flow is dependent on the PLF achieved and the incentive that is allowed for excess PLF achieved over and above 68.5%. Multiplying the rate of return with the equity investment made in the project gives the annual cash flow.

Power Purchase Agreement (PPA) - An agreement entered into between the IPP and the power purchaser for the purchase of power from the IPP. PPA is usually entered into for a period of 25 years.

Debt-Equity ratio - The promoter subject to the limiting value of the debt-equity ratio can regulate incurring of debt during construction period. Usually the equity is used up in the initial years of project construction activity and debt is availed to cover the expenses later. In power projects, the government has allowed the debt-equity ratio of 4:1, which has been taken as a norm for the current study. The interest on the debt is a pass through and the same comes as demand charges, which is recovered from the consumers of electricity.

Residual Value : Is the terminal payment that is received by an IPP for transferring the generating unit to an entity as per the provisions of the agreement. In the current study, it is taken at 5% of the total project cost based on the inputs of the field study.

Box 5: Assumptions for the risk analysis

a. The return is on the equity invested, which is assumed to remain constant throughout the project life.

b. The demand for power exceeds supply for the next 25 years as per the projections made by Central Electricity Authority and other agencies.

c. The simulation exercise is based on the inputs obtained from the survey and the policy parameters of Government of India's power policy as announced in the year 1996.

d. The risks that are expected from shortage in fuel supply are adequately covered in terms of ensuring adequate supply commitment from the fuel supplying company by entering into Fuel Supply Agreement. Similarly, water supply for thermal power plants is ensured by water supply agreement, with the state irrigation department. Further, to manage the cost on account of non - supply of water and fuel, appropriate provisions in power purchase agreement are incorporated.